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ABSTRACT

Although there has been a widely held impression that net benefits decline as more people seek and attain higher levels of education, investigations indicate that the rates of return have held roughly constant over a long period in the face of the universalization of secondary education and growing participation in tertiary education. The paper further explains the technique (formula) and data on which that conclusion is based. (Author/MSE)

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Rates of Return on Investments in Education 1890-1964*

David R. Witmer**

1971 and 1976

U.S. DEPARTMENT OF HEALTH, EDUCATION & WELFARE
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This is an extended note on a paper Professor W. Lee Hansen and I presented to the American Council on Education in Washington on the 7th of October, 1971 in which, among others, we addressed the question of whether the net benefits of investment in education (a) have fluctuated, (b) are rising or falling, and (c) will rise or fall during the decades ahead.[1] Although there has been a widely held impression that net benefits decline as more people seek and attain higher levels of education, our investigations indicated that the rates of return have held roughly constant over a long period in the face of the universalization of secondary education and growing participation in tertiary education. This note further explains the technique and data on which that conclusion was based.

Rates of return summarize four elements simultaneously: (a) supply of manpower, i.e., the number of persons with different levels and types of education available, (b) demand for different levels and types of manpower, (c) the earnings at which the supply and demand meet, and (d) the cost of providing educated manpower. The internal rate of return is the discount rate which equates the present value of lifetime earnings attributable to education and the costs of the education which yields those earnings. The formula for computing the internal rate of return on investment in different levels and types of education is as follows:[2]

$$f(R)=\sum_{t=1}^{n}(C_t-B_t)(1+R)^{n-t}=o$$

The computer program determines the rate, R, of growth of the net investments (C_t-B_t) to produce the benefits. C_t may be interpreted as the capital investments or costs during time periods t and B_t as the benefits from these investments, e.g., the difference between the average value of the earnings of persons with college and high school education respectively.

The algorithm used is a straight-forward determination of a gradually narrowing interval at the limits of which the function f(R) changes sign. First, f(D) is calculated, and then $f(D_1)$ $f(D_2)$. . . until $f(K_1D_1)$ is reached, where K_1 is the smallest integer K such that $(f(D_1))$ $(f(1.))$ is less than zero. Next, D_2 (which is equal to $-0.1D_1$) is included in the argument, and $f(K_1D_1D_2)$, $f(K_1D_1+2D_2)$, . . . are calculated until $f(K_1D_1+K_2D_2)$ is reached, where k_2 is the smallest integer k such that $(f(K_1D_1))$ $(f(K_1D_1+KD_2))$ is less than zero. This process is repeated until the annual rate of return at the desired (specified) accuracy is attained.

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* The original version of this paper was presented at the annual meeting of the Wisconsin Educational Research Association at Cardinal Stritch College, Milwaukee, Wisconsin on December 4, 1971. The paper was revised in 1976 to correct the year heading 1968 (the year of college graduation) to 1964 (the year of high school graduation and college entry).

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The internal rate of return figure generated by this procedure may be likened to the rate of return or the rate of interest received from placing funds in a savings bank, buying government bonds, or investing in corporate securities. Individuals will find it beneficial to invest in more education if the internal rate of return is higher than that to other types of investments. Whether society as a whole finds it efficient to invest in more education will depend upon the size of internal rates of return to education received by society relative to other investment opportunities open to it.

I provided a contemporary demonstration of the use of rate of return analysis in my dissertation on The Value of College Education . . .[3] That study was conducted within a conceptual system in which students, and society, through a number of different agents, invest in college education by paying (a) the costs of earnings foregone, (b) the extra costs of living at college vs. living at home, (c) the operating costs of college, (d) the cost of student financial aids, (e) the capital costs of physical facilities, (f) the costs of property and sales taxes foregone, and (g) the costs of borrowing for investment, in the expectation of (a) net lifetime earnings substantially higher than those of comparable persons who do not continue formal education beyond high school, and (b) productive contributions to economic growth and social welfare.

Costs and earnings were expressed in dollars of generally comparable value through the use of the consumer price index. Costs were divided between consumption (29 percent) and investment (71 percent).

Earnings data were adjusted to reflect the effects of (a) economic growth, (b) personal state and federal income taxes, and (c) mortality. The effects of (d) morbidity, (e) labor force participation, and (f) unemployment were implicit in the original earnings data. Earnings attributable to schooling (68.375 percent) were separated from those due to native ability and other factors.

The results of some of these rate of return computations are displayed under 1964 in Table I. Private rates of return are based on costs to students and earnings capturable by former students, i.e., after income taxes. Direct social rates of return are based on total (private plus public) costs and total earnings, i.e., before income taxes. Total social rates of return are based on total costs, and total earnings plus 44.8 percent, the estimated indirect (spillover effects, external economies, contributions to economic growth, etc.) benefits of investment in college education.

The results of rate of return computations by other researchers for the period 1939-59, while not based on exactly similar data and techniques, nevertheless provide useful estimates. The rates for 1890-1929 are based on application of the procedures described above to data from a variety of sources, as noted on Table 1.

1/ Cost and earnings data for 1929 were taken directly from Walsh. Costs were factored and reduced so that they included only the subsistence and maintenance cost directly attributable to formal education, i.e., attending school full-time as opposed to working fulltime. Cross-sectional earnings stream data from Walsh were tilted upward, in accordance with U.S. Census Bureau earnings reports, to reflect the effects of economic growth. Other procedures were analogous to those described in Witmer.

Estimated Annual Rates of Return on Investment in Education[a]

Men

	1890 Pvt.	1899 Pvt.	1909 Pvt.	1919 Pvt.	1929 Pvt.	1939 Soc. Dir.[b]	1939 Pvt.	1949 Soc. Dir.[b]	1949 Pvt.	1959 Social Tot.	1959 Social Dir.[b]	1959 Pvt.	1964 Social Tot.	1964 Social Dir.[b]	1964 Pvt.
Elementary	-	-	-	-	-	-	-	15.0[c]	-	-	-	19.4[d]	-	-	-
High School	9.9[e]	10.5[e]	17.9[e]	7.0[f]	7.5[g]	-	16.0[h]	11.4[c]	16.7[i]	28.0[h]	21.3[h]	19.7[j]	-	-	17.3[k]
Technical College	-	-	-	-	-	-	-	-	-	-	-	-	-	16.5[l]	19.1[l]
Junior College	-	-	-	-	-	-	9.9[h]	7.1[i]	6.4[i]	-	-	8.7[j]	16.5[m]	13.9[m]	11.5[m]
College (4 yrs.)	17.2[e]	13.6[e]	14.0[e]	10.8[f]	10.7[g]	13.3[h]	14.5[h]	11.4[i]	11.6[i]	25.0[h]	18.6[h]	12.2[j]	20.4[m]	16.1[m]	13.0[m]
Agriculture	10.7[e]	-	-	-	-	-	-	-	-	-	-	-	19.3[m]	14.5[m]	12.3[m]
Business	10.7[e]	10.6[e]	-	-	5.4[g]	-	-	-	-	-	-	-	28.6[m]	22.1[m]	18.5[m]
Dentistry	-	-	-	2.6[f]	-	-	12.3[o]	-	13.4[o]	-	-	-[p]	-	-	23.7[s]
Education	15.2[e]	7.3[e]	-	-	-	-	-	-	-	-	-	12.0[q]	21.1[m]	16.4[m]	14.4[m]
Engineering	17.9[e]	-	-	10.9[f]	11.5[g]	-	-	-	-	-	-	-	33.3[m]	24.5[m]	21.9[m]
Journalism	-	-	-	3.2[f]	-	-	-	-	-	-	-	-	19.0[m]	14.9[m]	13.2[m]
Law	-	5.8[e]	-	3.5[f]	8.8[g]	-	-	-	-	-	-	-	-	-	11.5[s]
Medicine	-	5.1[e]	-	2.3[f]	14.1[g]	-	13.5[o]	-	13.4[o]	-	-	12.8[q]	-	-	14.8[s]
Graduate School															
Master's	-	-	-	12.0[f]	14.1[g]	-	-	-	-	-	-	7.1[j]	-		8.0[u]
Doctorate	-	-	-	-	0.7[g]	-	-	-	2.6[q]	-	-	8.8[p]	-	3.4[r]	4.0[u]

Women

High School	-	-	-	5.7[f]	7.4[g]	-	-	-	-	-	-	-	-	-	10.3[m]
Junior College	-	-	-	-	-	-	-	-	-	-	-	-	17.8[m]	14.8[m]	12.2[m]
College (4 yrs)	-	-	-	8.5[f]	9.9[g]	-	-	-	-	-	-	-	27.7[m]	19.8[m]	23.7[m]
Education	-	-	-	5.7[f]	-	-	-	-	-	-	-	-	40.1[m]	28.8[m]	38.8[m]
Library Science	-	-	-	11.0[f]	-	-	-	-	-	-	-	-	36.0[m]	26.4[m]	32.9[m]
Nursing	-	-	-	12.5[f]	-	-	-	-	-	-	-	-	36.8[m]	26.9[m]	43.1[m]
Graduate School															
Master's	-	-	-	-	16.0[g]	-	-	-	-	-	-	-	-	-	-

Estimated Annual Rates of Return on Business Investments[t]

	-	-	-	-	-	12.6	7.0	14.4	7.0	-	10.6	7.0	-	-	-

Unemployment Rates

		5.0	5.2	2.3	3.2		17.2		5.5		5.5			3.6	

* (1956)

a. Based on data and findings in the studies listed below.

b. Social Direct: before income taxes; excludes externalities, spillover effects, indirect social benefits, and certain contributions to economic growth.

c. W. Lee Hansen, "Total and Private Rates of Return to Investment in Schooling," Journal of Political Economy, April, 1963.

d. Giora Hanoch, Personal Earnings and Investment in Schooling (Chicago: The University of Chicago, 1965).

e. Donald S. Bridgman, "Earnings of Land Grant College Alumni and Former Students", Journal of Engineering Education (November, 1931), pages 175-197.

J. C. Bowen and Estelle M. Stewart, History of Wages in the United States from Colonial Times . . . (Washington: U.S. Government Printing Office, 1934).

E. H. Phelps Brown, A Century of Pay (London: Macmillan, 1968).

Leonard R. Burgess, Wage and Salary Administration in a Dynamic Economy (New York: Harcourt Brace and World, 1968).

Harold F. Clark, Life Earnings . . . (New York: Harper, 1937).

Paul H. Douglas, Real Wages in the United States 1890-1926 (Boston: Houghton-Mifflin, 1930).

William DeWitt Hyde, The College Man and the College Woman (Boston: Houghton-Mifflin, 1906).

Clarence D. Long, Wages and Earnings in the United States 1860-1890 (Princeton: University Press, 1960).

National Industrial Conference Board, Conference Board Reports 1-18 (New York: The . . . Board, 1949).

National Industrial Conference Board, Wages in the United States, 1914-1926 (New York: The . . . Board, 1927).

Robert Ozanne, Wages in Practice and Theory (Madison: University of Wisconsin Press, 1968).

Albert Rees, New Measures of Wage-Earner Compensation in Manufacturing 1914-1957 (New York: National Bureau of Economic Research, 1960).

John W. Riegel, Salary Determination (Ann Arbor: University of Michigan, 1940).

Beardsley Ruml and Sidney G. Tickton, Teaching Salaries Then and Now (New York: Fund for the Advancement of Education, 1955).

U.S. Bureau of Labor Statistics, Employment and Earnings Statistics for the United States 1909-1960 (Washington: U.S. Government Printing Office, 1961).

John R. Walsh, "Capital Concept Applied to Man," Quarterly Journal of Economics, February, 1935.

David R. Witmer, The Value of College Education . . . (Ann Arbor: University Microfilms, 1971).

f. Clark, Walsh, and Witmer

g. Walsh and Witmer

h. Gary S. Becker, Human Capital (New York: National Bureau of Economic Research, 1964).

i. Becker and Hansen.

j. Becker and Hanoch.

k. Becker and Witmer.

l. Adger B. Carroll, Value of Human Capital . . . (Ann Arbor: University Microfilms, 1966).

m. Witmer.

n. Rolf V. Craft, Variations in the Costs and Benefits . . . (Ann Arbor: University Microfilms, 1968).

D. A. A. Stager, Monetary Returns to Post-Secondary Education . . . (Ann Arbor: University Microfilms, 1968), and Witmer.

o. W. Lee Hansen, "Shortages and Investment in Health Manpower," Proceedings of the Conference on the Economics of Health and Medical Care (Ann Arbor: The University of Michigan, 1964).

p. O. Ashenfeller and J. Mooney, "Some Evidence on the Private Returns to Graduate Education," Southern Economic Journal, January, 1969.

q. For the year 1947, from Shane J. Hunt, "Income Determinants for College Graduates and the Return to Educational Investment," Yale University Economic Growth Center, Paper No. 34, 1964).

r. Irene H. Butter, Economics of Graduate Education . . . (Ann Arbor: The University of Michigan, 1966).

s. D. A. A. Stager, Monetary Returns to Post-Secondary Education . . . (Ann Arbor: University Microfilms, 1968).

t. G. J. Stigler, Capital and Rates of Return in Manufacturing Industries (Princeton: National Bureau of Economic Research, 1963), page 34.

D. W. Jorgenson and Z. Griliches, "The Explanation of Productivity Changes," Review of Economic Studies, Vol. 34 (1967), page 268.

u. Paul J. Taubman and Terence Wales, Education as an Investment and a Screening Device (New York: National Bureau of Economic Research, 1972).

Data for 1919 were based on Clark, while data for 1909, 1899, and 1890 were based on Douglas. The choice of representative starting wages and salaries for persons with different levels of formal education was made after a review of the earnings and educational qualifications data in the other publications listed under e and f on Table 1. The construction of the lifetime earnings profiles also depended on careful judgment following a review of the published data. Public cost data necessary for the computation of social rates of return for the period prior to 1939 does not seem to be available in usable form. This regretable deficiency may not, however, be serious for social and private rates of return tend to be closely related.

At the close of the nineteenth century, three-fifths of the labor force was engaged in agriculture and in non-farm, unskilled labor. There were many opportunities for the uneducated and unskilled to gain good employment. The National Association of Manufacturers and other business groups criticized the schools and deprecated the value of education. Children generally left school at the age of twelve. Fewer than eleven percent of the 14 to 17 year old population attended secondary school; only four percent of the 18 to 21 year old population attended college. The annual rate of return on private investment in high school education was about ten percent. The rate of return rose to about 18 percent for students graduating from high school in 1909 but fell sharply to 7.0 and 7½, respectively, for the classes of 1919 and 1929, revealing how really deep the great depression was for some people.

By 1939-41 we had become an industrial society. The high school diploma was required at the threshold of good employment. High school enrollment exceeded 7 million students, representing 73 percent of the 14 to 17 year old population. The transition to universal secondary education was nearly complete. Despite this change, the annual rate of return on private investment in high school education stood at 16 percent, an attractive return by most any test.

Since 1960 we have become a post-industrial society. Only 5 percent of the labor force is unskilled. Opportunities for employment in service, technical, managerial, and professional occupations have increased more than 300 percent in one generation. Knowledge has become the central economic resource. Our society seeks to identify potential talent of many sorts and to furnish opportunities for these talents to reach fruition through education.[4] The rate of return to private investment in high school education stands at 17 percent per year, having continued at a high level ever since 1939.

The transition from universal elementary education to universal secondary education did not force rates of return on investments in high school downward, did not increase unemployment of high school graduates, did not cause wages of high school graduates to fall. Demand has increased sufficiently to forestall the forecasted surpluses of over-educated persons!

In 1939-41 total enrollment in tertiary education approximated 1.5 million, equal to less than 16 percent of the 18-21 year old age group. The rates of return to college investment were rather handsome, exceeding 13 percent for social investment and 14 percent for private investment. These rates compared very favorably to other investment opportunities open to society and individuals.

This favorable outlook was not expected to continue, however, as evidenced by the conclusions of Kotsching and Harris, both writing in the 1940's.[5] They variously hypothesized that as we approached universal higher education (a) college graduates would be in over supply relative to the occupations they would seek to enter,

with fewer and fewer uneducated people to do the less glamorous work; (b) the earnings of college graduates would fall relative to those of less-educated groups; (c) widespread unemployment of college graduates would result because of the nontransferability of skills; (d) idle, frustrated intellectuals would foment social revolution; (e) larger proportions of unqualified students would be enrolled in colleges, and as a consequence, (f) the social benefits to investing in college education would decline. No single person supported all of these hypotheses, some were mutually exclusive, but each hypothesis had proponents.

The following quotation from Cohn in the late 1940's captures the predominant tone:[6]

> "There will soon be more college graduates than there are jobs for them in their chosen fields. By 1950, for example, close to 50,000 engineers will be graduates, as against an annual replacement need of 7,000. Lawyers will become a surplus commodity with few takers, yet they continue to flock to college although many members of the class of 1948 are jobless. There is still room for chemists and psychologists but only if they have a graduate degree. There are already too many personnel men. The fields of physical education, social science, and English are crowded . . . Would . . . men who had undergone rigorous disciplines of study in order to get a degree just sit and take it when they found themselves jobless? Or, embittered and frustrated, would they become enemies of society as it is at present; fanatical advocates of some form of authoritarianism, more dangerous since they are ambitious, trained, and resentful?"

Did these dire predictions materialize? By 1950 college enrollments had jumped to 2.7 million. Meanwhile, the direct social and private rates of return had fallen about 15 and 20 percent to 11.4 and 11.6 respectively. Maybe there was something to the dire warnings after all! If so, we would have expected even more dramatic evidence of declining rates to emerge in the 1950's.

The 1950's saw a continued expansion of higher education, as enrollments increased to 3 million, equal to one-third of the 18-21 year old population. Notwithstanding, by the end of the decade social and private rates of return had risen sharply, to 18.6 and 12.2 percent respectively--the predictions did not materialize.

Expansion of higher education accelerated in the 1960's. At the end of the decade there were over 6 million students, undoubtedly including some of the sons and daughters of those jobless lawyers of the class of 1948! The number enrolled equaled 43 percent of the 18-21 year old population. The private and social rates of return by 1968 had not changed significantly, holding at about 16 and 13 percent, respectively.

In reviewing the past 20 years it is obvious that the Kotsching-Harris-Cohn pronostications were far off the mark, for at least until the last year the market for college graduates has been booming. Admittedly, periodic recessions have slowed the demand somewhat, and the recent recession of 1969-71 has further altered the demand for college graduates.

Were Harris' book, with its predictions, to appear today, it would no doubt generate a sympathetic readership, much as it did when first published during the recession of 1949.[7] But whether current and analogous statements such as those by Berg, Faltermayer, and TIME magazine should give us great cause for concern about the next 20 years is debatable.[8]

The U.S. Bureau of Labor Statistics' projections of industry and occupational manpower needs generally indicate the continuation of long-term trends toward service fields rather than dramatic, sudden shifts during the 1970's. Needs for professional and technical workers are expected to increase about 50 percent--faster than any other occupational group in the labor force--while the downward trend, since 1900, for blue collar workers will continue so that by 1980 they may be only 33 percent of all workers.[9] There seems to be little reason to fear that college-educated persons will not be able to make their way into the wide variety of occupations they have sought out during past decades. It is certainly clear, however, that as the proportion of college graduates rises relative to the total adult population, more college-educated people will have to seek positions in other occupations. This, however, has always been the case.[10] Whether or not college graduates will be eagerly sought for those other occupations depends in part on the types of skills and training which they bring with them. So, while relative numbers are of great importance, of even greater importance is the potential productivity which is associated with the college degree. We do not assume that the differential earnings to college graduates are automatically going to fall either slowly or precipitously. They may decline, and certainly will do so in some fields (in other fields they will increase), but we can expect these changes to trigger adjustive responses on the part of college-educated persons as they make their career and educational decisions.

Walter Gifford's 1928 statement has held true: "The more education you have, the more money you make!"[11] Investments in successively higher levels of formal education, however, have yielded successively lower rates of return and rates of return on investments in college education have varied greatly by major program of study. Although the rates of return on investment in education fell dramatically as the classes of 1919-1929 passed through the great depression, demand for educated people has balanced supply while educational opportunity has been extended to the masses. The development and application of complex procedures for measuring the value of education in economic terms has not uncovered startlingly new truths, nor has it revealed dramatic shifts in the relative values of investment at different levels and in different programs of education. Old hypotheses have been strengthened. The pessimistic hypotheses published during the late 1940's have been denied. The pessimistic hypotheses being formulated during the 1969-71 recession are under a cloud of doubt; their validation or denial lies ahead.

Notes

1. W. Lee Hansen and David R. Witmer, "Economic Benefits of Higher Education," Universal Higher Education, Costs and Benefits (Washington: American Council on Education, 1971), pages 16-36.

2. Burton Weisbrod, John Melder, and others RATBENI Rate of Return (Madison: Data and Program Library Service, Social Science Research Center, The University of Wisconsin, 1967).

3. David R. Witmer, The Value of College Education: A Benefit-Cost Analysis of Major Programs of Study in the Wisconsin State Universities (Ann Arbor University Microfilms, 1971), pages 37-65, 333-339, and 347-353.

4. Ralph W. Tyler, "National Assessment: A History and Sociology," School and Society (December, 1970), pages 472 and 473.

5. Walter Kotsching, Slaves Need No Leaders (London: Oxford University Press, 1943), and Seymour Harris, The Market for College Graduates (Cambridge: Harvard University Press, 1949).

6. David L. Cohn, "Who Will Do the Dirty Work?" Atlantic Monthly, (May, 1949).

7. Harris is still claiming that the impact of rising numbers of college graduates depresses earnings and the highly educated then respond by deserting the market or accepting positions below their expectations.

   Seymour E. Harris, "Book Reviews," Journal of Higher Education, (January, 1971), page 81.

8. Ivar Berg, Education and Jobs: The Great Training Robbery, (New York: Praeger, 1970).

   Edmund K. Faltermayer, "Let's Break the Go-To-College Lockstep," Fortune (November, 1970), pages 83-103 and 144.

   "Graduates and Jobs: A Grave New World," Time (May 24, 1971), pages 49-59.

9. E. B. Sheldon, W. E. Moore, and others, Indicators of Social Change, (New York: Russell Sage Foundation, 1968).

   Russell B. Flanders, "Employment Patterns for the 1970's" Occupational Outlook Quarterly (Summer, 1970), page 6.

10. Richard B. Freeman, The Market for College-Trained Manpower, A Study in the Economics of Career Choice (Cambridge: Harvard University Press, 1971).

11. Walter S. Gifford, "Does Business Want Scholars?" Harper's Monthly Magazine, Vol. CLVI (May, 1928), pages 669-674.

    Walter S. Gifford, Addresses, Papers, and Interviews 1913-1928, 3 vols., (New York: Information Department of the American Telephone and Telegraph Company, 1928-1944), Vol. I, pages 240-248.

    Robert M. Hutchins, "Preface to the Paperbound Edition (1965)," The Higher Learning in America, (New Haven: Yale University Press, 1936), page x.